Precomputing the branch metrics for all possible symbol combinations in the channel memory makes it possible to remove the branch metrics unit and decision-feedback unit from the feedback loop, thereby reducing the critical path. A set of multiplexers select the appropriate branch metrics based on the survivor symbols in the corresponding survivor path cells. The computational load of the precomputations is reduced for multi-dimensional trellis codes by precomputing each dimension of the multi-dimensional trellis code separately. A hybrid survivor memory architecture is also disclosed for a RSSE for a channel having a channel memory of length L, where the survivors corresponding to the L past decoding cycles are stored in a register exchange architecture (REA), and survivors corresponding to later decoding cycles are stored in a trace-back architecture (TBA) or REA.

IN THE CLAIMS:

Please amend the claims as indicated below:

Please cancel claims 39-46, without prejudice.

1. (Amended) A method for processing a signal using a reduced complexity sequence estimation technique, said method comprising the steps of:

precomputing branch metrics;

selecting one of said precomputed branch metrics based on at least one decision from at least one corresponding state; and

selecting a path having a best path metric for a given state.

2. (Amended) The method of claim 1, wherein said precomputed branch metrics is given by:

$$\tilde{\lambda}_n(z_n, a_n, \tilde{\alpha}) = (z_n - a_n + \tilde{u}(\tilde{\alpha}))^2 .$$

wherein an intersymbol interference estimate is obtained by evaluating the following equation:

$$\tilde{u}(\tilde{\alpha}) = -\sum_{i=1}^{L} f_i \tilde{a}_{n-i}$$

and wherein z_n is the detector input at time instant n, L is a channel memory length, $\{f_i\}$, $i \in [0,..,L]$ are coefficients of the equivalent discrete-time channel impulse response, a_n is a channel symbol, and $\tilde{\alpha} = (\tilde{a}_{n-L}, \dots, \tilde{a}_{n-1})$ is a sequence of channel symbols.

3. (Unamended) The method of claim 1, wherein said path metric is an accumulation of said corresponding branch metrics over time.

B1 A3

4. (Amended) The method of claim 1, wherein an appropriate branch metrics $\lambda_n(z_n, a_n, \rho_n)$ is selected from said precomputed branch metrics $\tilde{\lambda}_n(z_n, a_n, \tilde{\alpha})$ using the survivor path $\hat{\alpha}_n(\rho_n)$:

$$\lambda_n(z_n, a_n, \rho_n) = sel\{\Lambda_n(z_n, a_n, \rho_n), \hat{\alpha}_n(\rho_n)\}.$$

wherein $\Lambda_n(z_n, a_n, \rho_n)$ is a vector containing the branch metrics $\tilde{\lambda}_n(z_n, a_n, \tilde{\alpha})$, which can occur for a transition from state ρ_n and which correspond to channel symbol a_n, but different channel sequences $\tilde{\alpha}$, and wherein $\hat{\alpha}_n(\rho_n)$ is the survivor sequence leading to state ρ_n.

5. (Unamended) The method of claim 1, wherein said best path metric is a minimum or maximum path metric.

B1 A4

6. (Amended) The method of claim 1, wherein said reduced complexity sequence estimation technique is a reduced state sequence estimation technique.

7. (Amended) The method according to claim 6, wherein said reduced state sequence estimation technique is a delayed decision-feedback sequence estimation technique.

8. (Amended) The method according to claim 6, wherein said reduced state sequence estimation technique is a parallel decision-feedback equalization technique.

9. (Unamended) The method of claim 1, wherein said reduced complexity sequence estimation technique is an implementation of the Viterbi algorithm.

10. (Unamended) The method of claim 1, wherein said reduced complexity sequence estimation technique is an implementation of the M algorithm.

11. (Amended) The method of claim 1, wherein said decisions from a corresponding state is a survivor symbol.

12. (Amended) The method of claim 1, wherein said decision from a corresponding state is an add-compare-select decision.

13. (Amended) A method for processing a multi-dimensional signal using a reduced complexity sequence estimation technique, said channel having a channel memory, said method comprising the steps of:

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precomputing one-dimensional branch metrics for each dimension of the multi-dimensional signal;

selecting one of said precomputed one-dimensional branch metric based on at least one decision from at least one corresponding state; and

combining said selected one-dimensional branch metrics to obtain a multi-dimensional branch metric.

14. (Amended) The method of claim 13, wherein said one-dimensional branch metric in the dimension j is precomputed by evaluating the following expressions:

$$\tilde{\lambda}_{n,j}(z_{n,j}, a_{n,j}, \tilde{\alpha}_j) = (z_{n,j} - a_{n,j} + \tilde{u}_j(\tilde{\alpha}_j))^2 \text{ and } \tilde{u}_j(\tilde{\alpha}_j) = -\sum_{i=1}^{L} f_{i,j}\tilde{a}_{n-i,j},$$

wherein $z_{n,j}$ is the detector input, $a_{n,j}$ is channel symbol at time n and $\tilde{\alpha}_j = (\tilde{a}_{n-L,j}, \ldots, \tilde{a}_{n-1,j})$ is a sequence of channel symbols in dimension j, L is a channel memory length, B is the number of dimensions, and $\{f_{i,j}\}$, $i \in [0, \ldots, L]$, $j \in [1 \ldots, B]$ are coefficients of the equivalent discrete-time channel impulse response.

15. (Amended) The method of claim 13, wherein said selection of an appropriate one-dimensional branch metrics for further processing with a reduced complexity sequence estimator is given by:

$$\lambda_{n,j}(z_{n,j}, a_{n,j}, \rho_n) = sel\{\Lambda_{n,j}(z_{n,j}, a_{n,j}), \hat{\alpha}_{n,j}(\rho_n)\}$$

wherein $\Lambda_{n,j}(z_{n,j}, a_{n,j})$ is the vector containing possible one-dimensional branch metrics $\tilde{\lambda}_{n,j}(z_{n,j}, a_{n,j}, \tilde{\alpha}_j)$ for the same channel symbol $a_{n,j}$, but different channel symbol sequences $\tilde{\alpha}_j$ and

$\hat{\alpha}_{n,j}(\rho_n)$ is the survivor sequence in dimension j leading to state ρ_n.

16. (Amended) The method of claim 13, wherein said decision from a corresponding state is a survivor symbol.

17. (Amended) The method of claim 13, wherein said decision from a corresponding state is an add-compare-select decision.

18. (Amended) A method for processing a multi-dimensional signal using a reduced complexity sequence estimation technique, said method comprising the steps of:

B1 cont

precomputing one-dimensional branch metrics for each dimension of the multi-dimensional signal;

combining said one-dimensional branch metrics into at least two-dimensional branch metrics; and

selecting one of said at least two-dimensional branch metrics based on at least one decision from at least one corresponding state.

19. (Amended) The method of claim 18, wherein said one-dimensional branch metric in the dimension j is precomputed by evaluating the following expressions:

$$\tilde{\lambda}_{n,j}(z_{n,j},a_{n,j},\tilde{\alpha}_j)=(z_{n,j}-a_{n,j}+\tilde{u}_j(\tilde{\alpha}_j))^2 \text{ and } \tilde{u}_j(\tilde{\alpha}_j)=-\sum_{i=1}^{L} f_{i,j}\tilde{a}_{n-i,j},$$

wherein $z_{n,j}$ is the detector input, $a_{n,j}$ is channel symbol at time n and $\tilde{\alpha}_j=(\tilde{a}_{n-L,j},\ldots,\tilde{a}_{n-1,j})$ is a sequence of channel symbols in dimension j, L is a channel memory length, B is the number of dimensions, and $\{f_{i,j}\}$, $i\in[0,\ldots,L]$, $j\in[1\ldots,B]$ are coefficients of the equivalent discrete-time channel impulse response.

20. (Amended) The method of claim 18, wherein said selection of an appropriate at least two-dimensional branch metrics corresponding to a particular state and channel symbol for further processing with a reduced complexity sequence estimator is based on the survivor symbols for said state and said at least two dimensions and said selection is performed among said precomputed at least two-dimensional branch metrics for said state, channel symbol and different

B1 cont.

previous channel symbol sequences.

21. (Amended) The method of claim 18, wherein said decision from a corresponding state is a survivor symbol.

22. (Amended) The method of claim 18, wherein said decision from a corresponding state is an add-compare-select decision.

23. (Unamended) The method of claim 18, further comprising the step of combining said selected at least two-dimensional branch metric to obtain a multi-dimensional branch metric.

B2 cont.

24. (Amended) A method for processing a signal received from a channel using a reduced complexity sequence estimation technique, said method comprising the steps of:

prefiltering said signal to shorten a memory of said channel;

precomputing branch metrics for possible values of said shortened channel memory;

selecting one of said precomputed branch metrics based on at least one decision from at least one corresponding state; and

selecting a path having a best path metric for a given state.

25. (Amended) The method of claim 24, wherein said prefiltering step further comprises the step of processing less significant taps with a lower complexity cancellation algorithm that cancels the less significant taps using tentative decisions and processing more significant taps with a reduced state sequence estimation technique.

26. (Amended) The method according to claim 24, wherein said lower complexity cancellation algorithm is a decision feedback prefilter technique.

27. (Unamended) The method according to claim 24, wherein said lower complexity cancellation algorithm utilizes a linear equalizer technique.

28. (Amended) The method according to claim 24, wherein said lower complexity cancellation algorithm is a soft decision feedback prefilter technique.

29. (Unamended) The method according to claim 24, wherein said lower complexity cancellation algorithm reduces the intersymbol interference associated with said less significant taps.

30. (Unamended) The method according to claim 24, wherein said more significant taps comprise taps below a tap number, U, where U is a prescribed number less than L.

31. (Amended) The method according to claim 24, wherein said reduced complexity sequence estimation technique is a delayed decision-feedback sequence estimation technique.

32. (Amended) The method according to claim 24, wherein said reduced complexity sequence estimation technique is a parallel decision-feedback equalization technique.

33. (Amended) The method according to claim 24, wherein said reduced complexity sequence estimation technique is a reduced state sequence estimation technique.

34. (Unamended) The method according to claim 24, wherein said reduced complexity sequence estimation technique is an implementation of the Viterbi algorithm.

35. (Unamended) The method according to claim 24, wherein said reduced complexity sequence estimation technique is an implementation of the M algorithm.

36. (Amended) The method of claim 24, wherein said decision from a corresponding state is a survivor symbol.

37. (Amended) The method of claim 24, wherein said decision from a corresponding state is an add-compare-select decision.

38. (Amended) A method for processing a signal received from a channel using a reduced complexity sequence estimation technique, said method comprising the steps of:

prefiltering said signal to shorten a channel memory;

precomputing a one-dimensional branch metric for possible values of said shortened channel memory and for each dimension of the multi-dimensional signal;

combining said one-dimensional branch metric into at least two-dimensional branch metrics; and

selecting one of said at least two-dimensional branch metrics based on at least one decision from at least one corresponding state.

39. (Cancelled)

40. (Cancelled)

41. (Cancelled)

42. (Cancelled)

43. (Cancelled)

44. (Cancelled)

45. (Cancelled)

46. (Cancelled)

47. (Amended) A reduced complexity sequence estimator comprising:

a branch metrics unit for precomputing branch metrics;

a multiplexer for selecting one of said precomputed branch metrics based on at least one decision from at least one corresponding state; and

an add-compare-select unit for selecting a path having a best path metric for a given state.

48. (Amended) The reduced complexity sequence estimator of claim 47, wherein said decision from a corresponding state is taken from the survivor memory unit.

49. (Amended) The reduced complexity sequence estimator of claim 47, wherein said decision from a corresponding state is taken from the add-compare-select unit.

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50. (Amended) A reduced complexity sequence estimator for processing a multi-dimensional signal comprising:

a branch metrics unit for precomputing one-dimensional branch metrics for each dimension of the multi-dimensional trellis code;

a multiplexer for selecting one of said precomputed one-dimensional branch metric based on at least one decision from at least one corresponding state; and

a multi-dimensional branch metric computation unit for computing a multi-dimensional branch metric based on said selected one-dimensional branch metrics.

51. (Amended) The reduced complexity sequence estimator of claim 50, wherein said decision from a corresponding state is available in the survivor memory unit.

52. (Amended) The reduced complexity sequence estimator of claim 50, wherein said decision from a corresponding state is available in the add-compare-select unit.

53. (Amended) A reduced complexity sequence estimator for processing a multi-dimensional signal comprising:

a branch metrics unit for precomputing one-dimensional branch metrics for each dimension of the multi-dimensional signal;

means for combining said one-dimensional branch metric into at least two-

dimensional branch metrics;

a multiplexer for selecting one of said at least two-dimensional branch metrics based on at least one decision from at least one corresponding state; and

a multi-dimensional branch metric unit for combining said selected at least two-dimensional branch metric to obtain a multi-dimensional branch metric.

54. (Amended) The reduced complexity sequence estimator of claim 53, wherein said decision from a corresponding state is based on a survivor symbol in a corresponding survivor path cell.

B3 cont.

A4 cont.

55. (Amended) The reduced complexity sequence estimator of claim 53, wherein said decision from a corresponding state is based on a decision from a corresponding add-compare-select cell.

56. (Amended) A reduced complexity sequence estimator for processing a signal received from a channel comprising:

a prefilter to shorten a channel memory;

a branch metrics unit for precomputing branch metrics for possible values of said channel memory;

a multiplexer for selecting one of said precomputed branch metrics based on at least one decision from at least one corresponding state; and

an add-compare-select unit for selecting a path having a best path metric for a given state.

57. (Amended) The reduced complexity sequence estimator of claim 56, wherein said decision from a corresponding state is based on a survivor symbol in the survivor memory unit.

58. (Amended) The reduced complexity sequence estimator of claim 56, wherein said decision from a corresponding state is based on an add-compare-select decision.